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Pre and Postnatal Magnetic Resonance Imaging of Ventriculomegaly

Ryan Kelsch

Megan Moore

Anant Krishnan

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Beaumont

Ryan Kelsch, DO[1]; Megan Moore, BS[2]; Anant Krishnan, MD[1]

[1]Department of Diagnostic Radiology and Molecular Imaging, Beaumont Hospital, Royal Oak, MI ▪ [2]Oakland University William Beaumont School of Medicine, Rochester, MI

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Background

Fetal ventriculomegaly can be measured prenatally by ultrasound or magnetic resonance imaging (MRI).[1] In up to 85% of cases, it can be associated with other CNS abnormalities. Fetal ventriculomegaly can have many etiologies and varying neurodevelopmental outcomes based on associated abnormalities and the exact etiology in the patient.[2] In general, fetuses with mild ventriculomegaly (10-12 mm) have better outcomes than those with severe ventriculomegaly (>15 mm).[3]

We analyzed our institution's database of fetal MRI over the past ten years for cases of ventriculomegaly (lateral ventricles measuring >10 mm) to understand trends in pre and postnatal MR and its correlation to clinical outcomes.

Methods

Our fetal MR database was reviewed for examinations with the ordering indication of ventriculomegaly, or where ventriculomegaly was reported in the findings, in examinations performed over the last 10 years. With those inclusion criteria, we identified 86 patients. We then only included cases that had both prenatal MR of the fetus and postnatal MR of the child, yielding 21 cases in our study. Medical records and imaging review were performed in these cases to confirm ventriculomegaly and assess neurological outcomes. Poor outcome was defined as permanent neurological deficits including seizures and developmental delay. The majority of the clinical outcome information was collected from the first few years of life.

361 Fetal MRs at Beaumont in the last 10 years

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86 Studies with a finding of ventriculomegaly or ordering indication of ventriculomegaly

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21 Cases with pre and postnatal MR scan

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Patient Chart and Imaging Review

Results

Twenty one MRI studies were performed on fetuses who ranged in gestational age from 20 weeks to 36 weeks (mean 30.7 weeks). The mothers' ages ranged between 16 and 40 years (mean 28 years). Postnatal MRIs were performed between 0 days and 3 years. The etiology of the ventriculomegaly was identified prenatally in 10 cases, postnatally in 4 cases, and were indeterminate in 7 cases. Neurological outcomes are summarized in table 1. Case details, as well as post and prenatal diagnoses by modality are summarized in table 2.

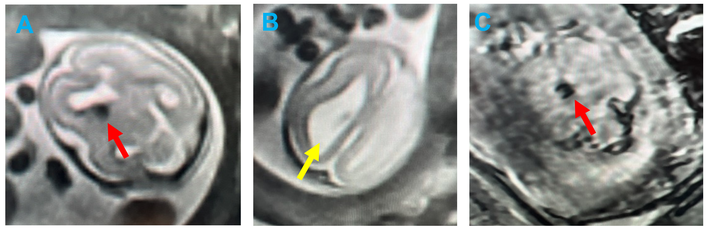
*Table 1. Neurological outcome. *One patient was too young to determine the neurological outcome.*

Severity on Prenatal Imaging	# of Cases	Number with Poor Neurological Outcome
Mild Ventriculomegaly (10-12 mm)	9	2
Moderate Ventriculomegaly (12-15 mm)	6	6
Severe Ventriculomegaly (>15 mm)	6	4*

Table 2. Summary of Cases, Key: AS=Aqueductal stenosis, PVL=Periventricular leukomalacia, CMV=Cytolomegalovirus

Severity of Ventriculomegaly	Maternal Age (Years)	Prenatal US Findings/Etiology	Fetal Age MR (Weeks)	Prenatal MR Findings/Etiology	Child age at MR	Postnatal MR Findings/Etiology	Pre vs postnatal MR Etiology for Ventriculomegaly
Mild	33	Intracranial hemorrhage	21	Germinal matrix hemorrhage (figure 1)	10 Mo	Germinal Matrix Hemorrhage	Prenatal MR
	26	Suspected Schizencephaly	32	Schizencephaly	0 Dy	Schizencephaly	Prenatal MR
	22	Mild ventriculomegaly	36	Mild asymmetric ventriculomegaly	6 Mo	PVL	Postnatal MR
	26	Mild left ventriculomegaly	28	Potential AS, 3rd ventricle however not enlarged	2 Wk	Progressive hydrocephalus over studies, probable partial AS	Postnatal MR
	20	CMV Infection	32	CMV Infection	2 Wk	CMV Infection	Prenatal MR
	16	Congenital infection vs ventricular hemorrhage	36	CMV Infection	1 Mo	CMV Infection	Prenatal MR
	27	Mildly dilated right lateral ventricle atrium	36	Mildly dilated right lateral ventricle atrium	3 Mo	Ventricles slightly prominent	No definite cause
	33	Mild asymmetric ventriculomegaly	33	Mild asymmetric ventriculomegaly	7 Dy	Mildly asymmetric lateral ventricles	No definite cause
	32	Borderline ventriculomegaly	32	Borderline ventriculomegaly	2 Yr	Normal	No definite cause
Moderate	23	Borderline ventriculomegaly	30	PVL vs CMV	7 Dy	Favor CMV over PVL due to calcifications, no confirmatory testing	Postnatal MR
	31	Ventriculomegaly	22	Mild enlargement of posterior aspects of bilateral lateral ventricles	3 Yr	Aqueductal stenosis	Postnatal MR
	22	Ventriculomegaly, cystic area in left frontal area in communication with lateral ventricle	33	Porencephaly, hemorrhage	3 Yr	Porencephaly, hemorrhage	Prenatal MR
	30	Left lateral ventricle mildly enlarged	32	Colpocephaly, partial agenesis of the corpus callosum	9 Dy	Colpocephaly, partial agenesis of the corpus callosum	Prenatal MR
	39	Mild ventriculomegaly	30	Hypoxic ischemic insult and/or infection	25 Dy	Hypoxic ischemic insult	Prenatal MR
	34	Mild ventriculomegaly	30	Mild ventriculomegaly	3 Dy	Mild ventriculomegaly	NA
Severe	31	Asymmetric ventriculomegaly	25	Porencephalic Cyst	3 Dy	Porencephalic Cyst	Prenatal MR
	27	Likely AS	29	AS	5 Dy	AS	Prenatal MR
	23	Ventriculomegaly, repaired myelomeningocele	31	Chiari II, repaired myelomeningocele	6 Mo	Chiari II, repaired myelomeningocele	Prenatal MR
	28	Severe ventriculomegaly	35	Severe ventriculomegaly	2 Wk	Improvement of ventriculomegaly	No definite cause
	25	Ventriculomegaly	30	Ventriculomegaly severe in left lateral and moderate on right lateral	2 Mo	Left ventriculomegaly	No definite cause
	40	Severe ventriculomegaly	33	Severe ventriculomegaly, possible AS	9 Mo	Improvement of ventriculomegaly status post shunt placement	No definite cause

Figure 1. A, B, axial SS-FSE, and C, axial gradient echo images demonstrate low signal within the right caudothalamic groove area consistent with germinal matrix hemorrhage (red arrows), with associated ventriculomegaly (yellow arrow).



Discussion

Our study demonstrates the utility of fetal MR in further characterizing ventriculomegaly, with 48% (10/21) patients receiving a definite cause for the ventriculomegaly based on fetal MRI. Our study also confirms previously reported studies that fetuses with mild ventriculomegaly more often have a normal neurological outcome (78%, 7/9) when compared to those with moderate to severe ventriculomegaly. Limitations of this study include the relatively small sample of cases that had both pre and postnatal MR imaging within our hospital database.

Conclusions

Fetal MRI adds to ultrasound in the characterization, confirmation and identification of potential causes for ventriculomegaly. However there is still utility in post natal MRI by its superior spatial and contrast resolution including confirming less typical cases such as partial aqueductal stenosis, and differentiating calcifications from hemorrhage, thereby improving confidence in diagnosis.

References

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